Attorney Docket No.: First Inventor: Title:

NEC0250US Wolfgang Roethig

System And Method For Calculating Effective Capacitance For

Timing Analysis

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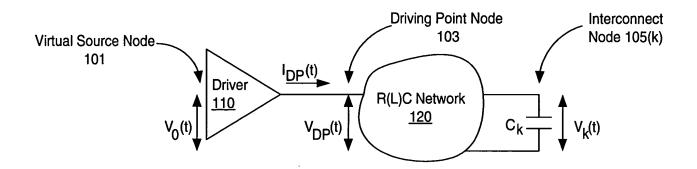


FIG. 1 - Prior Art

$$C_{\text{eff}} \cdot V(T) = \sum_{k=1}^{N} C_k \cdot V_k(T) \qquad \text{Eq. 1}$$

$$V(t) \qquad \qquad C_{\text{eff}}$$

FIG. 2 - Prior Art

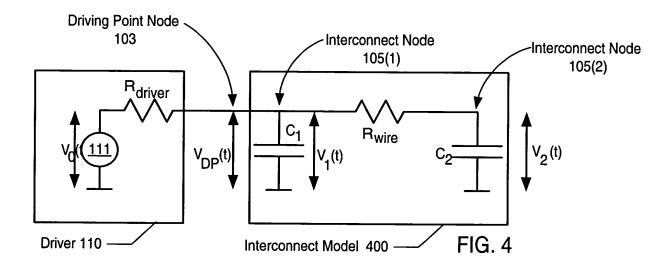
$$C_{\text{eff}} = \sum_{k=1}^{N} C_k \cdot \frac{V_k(T)}{V_{\text{DP}}(T)} \qquad \text{Eq. 2}$$

FIG. 3

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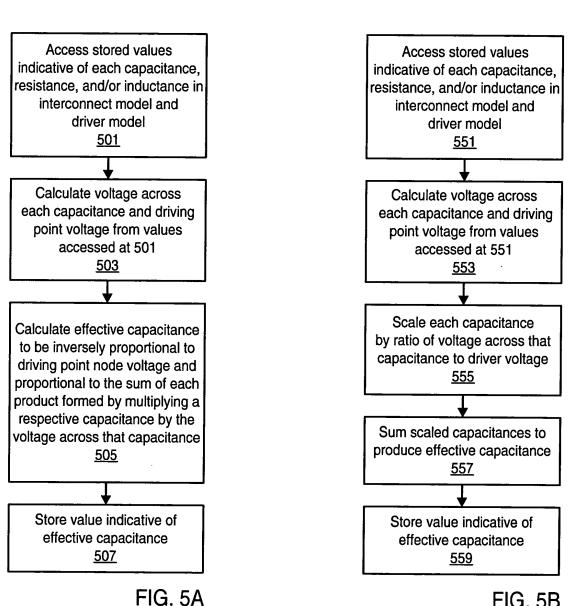


FIG. 5B

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Eqs. 3 
$$T_{11} = R_{driver} \cdot C1$$
  $T_{12} = R_{driver} \cdot C2$   $T_{22} = R_{wire} \cdot C2$ 

Eqs. 4 
$$T_{Elmore} = T_{11} + T_{12} + T_{22}$$
  $T_{Root} = \sqrt{T_{Elmore} - 4 \cdot T_{11} \cdot T_{22}}$ 

Eqs. 5 
$$s_{1,2} = \frac{\pm T_{Root} - T_{Elmore}}{2 \cdot T_{11} \cdot T_{22}}$$

Eqs. 6 
$$au_1^1 = -\frac{1 + s_1 \cdot T_{22}}{T_{\text{Root}} \cdot s_1^2}$$
  $au_2^1 = \frac{1 + s_2 \cdot T_{22}}{T_{\text{Root}} \cdot s_2^2}$   $au_1^2 = -\frac{1}{T_{\text{Root}} \cdot s_1^2}$   $au_2^2 = \frac{1}{T_{\text{Root}} \cdot s_2^2}$ 

Eqs. 7
$$V_{1}(t) = \begin{cases} 0 & t < 0 \\ \frac{1}{T} \cdot \left(t + \tau_{1}^{1}(1 - \exp(s_{1}t)) + \tau_{2}^{1}(1 - \exp(s_{2}t))\right) & 0 \le t \le T \\ 1 + \frac{1}{T} \cdot \left(\tau_{1}^{1}(1 - \exp(s_{1}T)) \exp(s_{1}(t - T)) + \tau_{2}^{1}(1 - \exp(s_{2}t)) \exp(s_{2}(t - T))\right) & T < t \end{cases}$$

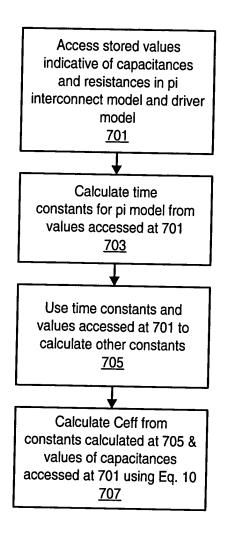
$$V_{2}(t) = \begin{cases} 0 & t < 0 \\ \frac{1}{T} \cdot \left(t + \tau_{1}^{2}(1 - \exp(s_{1}t)) + \tau_{2}^{2}(1 - \exp(s_{2}t))\right) & 0 \le t \le T \\ 1 + \frac{1}{T} \cdot \left(\tau_{1}^{2}(1 - \exp(s_{1}T)) \exp(s_{1}(t - T)) + \tau_{2}^{2}(1 - \exp(s_{2}t)) \exp(s_{2}(t - T))\right) & T < t \end{cases}$$

Eq. 8 
$$Ceff = C1 + C2 \cdot \frac{V_2(T)}{V_1(T)}$$

Eq. 9 
$$Ceff = C1 + C2 \cdot \frac{T + \tau_1^2 (1 - \exp(s_1 T)) + \tau_2^2 (1 - \exp(s_2 T))}{T + \tau_1^1 (1 - \exp(s_1 T)) + \tau_2^1 (1 - \exp(s_2 T))}$$

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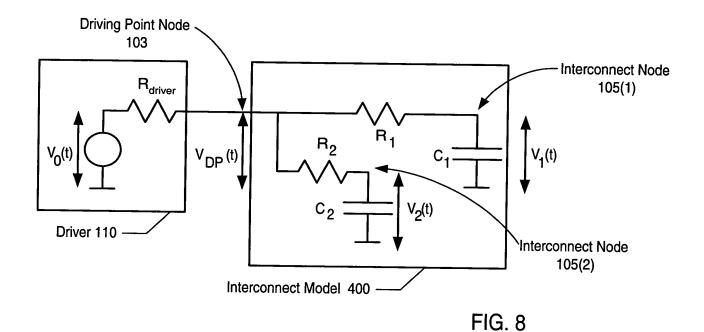


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Interconnect Node 105(1) **Driver** 110 Interconnect Model 400  $I_{DP}(t)$ L<sub>driver</sub> **R**driver  $\mathsf{R}_{\mathsf{wire}}^{\mathsf{T}}$ Lwire C<sub>wire</sub> :  $V_{DP}(t)$ Driver 110 Interconnect Model 400 FIG. 9

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